THAT WHICH IS CLAIMED:

1. A fiber optic rotary joint for providing optical communication between a rotor and a stator comprising:

an optical source carried by one of the rotor and the stator for transmitting optical signals;

an elliptical reflector mounted upon the other one of the rotor and the stator for reflecting the optical signals, said elliptical reflector comprising a reflective surface shaped to define a portion of an ellipse, wherein the elliptically shaped reflective surface defines first and second focal points and is positioned such that the first focal point lies along a central axis of the rotor; and

a receiver disposed to receive the reflected optical signals.

2. A fiber optic rotary joint according to Claim 1 further comprising a hyperbolic reflector for reflecting the signals received from said elliptical reflector, said hyperbolic reflector comprising a reflective surface shaped to define a portion of a hyperbola, wherein the hyperbolically shaped reflective surface defines a back focal point and a conjugate focal point.

3. A fiber optic rotary joint according to Claim 2 wherein the second focal point of said elliptical reflector and the back focal point of said hyperbolic reflector are coincident.

4. A fiber optic rotary joint according to Claim 2 wherein said receiver is disposed at the conjugate focal point of said hyperbolic reflector.

5. A fiber optic rotary joint according to Claim 1 wherein said receiver is disposed at the second focal point of said elliptical reflector.

6. A fiber optic rotary joint according to Claim 1 further comprising a slip ring adapted to rotate with the rotor, wherein said slip ring defines a reference plane, and

wherein said elliptical reflector is positioned such that the first focal point lies in the reference plane at a center of said slip ring and the second focal point lies outside of the reference plane.

7. A fiber optic rotary joint according to Claim 1 wherein said elliptical reflector receives optical signals having a plurality of different angles of incidence, and wherein said elliptical reflector is positioned such that a path length from said optical source to said receiver is identical for all optical signals reflected by said elliptical reflector regardless of the angle of incidence.

8. A fiber optic rotary joint according to Claim 1 further comprising a plurality of circumferentially spaced optical sources carried by the rotor, wherein said elliptical reflector is mounted upon the stator for receiving optical signals from said plurality of optical sources.

9. A fiber optic rotary joint according to Claim 1 further comprising a plurality of optical sources for transmitting optical signals having different respective wavelengths.

10. A fiber optic rotary joint according to Claim 9 further comprising an optical coupler for combining the optical signals having different respective wavelengths.

11. A fiber optic rotary joint according to Claim 9 wherein said receiver comprises a plurality of detectors for receiving optical signals having a respective wavelength.

12. A fiber optic rotary joint according to Claim 11 wherein said receiver further comprises a splitter for separating the optical signals having different respective wavelengths prior to reception by said detectors.

13. A fiber optic rotary joint according to Claim 1 wherein said optical source comprises an array of vertical cavity surface emitting lasers (VCSELs).

14. A fiber optic rotary joint according to Claim 1 further comprising a plurality of elliptical reflectors mounted upon and spaced apart about the other one of the rotor and the stator for reflecting the optical signals incident thereupon.

15. A fiber optic rotary joint according to Claim14 further comprising a coupler for combining the optical signals reflected by the plurality of elliptical reflectors prior to receipt by said receiver.

16. A fiber optic rotary joint according to Claim 14 wherein the plurality of elliptical reflectors comprises four circumferentially spaced elliptical reflectors for receiving different respective optical signals.

17. A fiber optic rotary joint for providing optical communication between a rotor and a stator comprising:

an optical source carried by one of the rotor and the stator for transmitting optical signals;

a hyperbolic reflector mounted upon the other one of the rotor and the stator for reflecting the optical signals, said hyperbolic reflector comprising a reflective surface shaped to define a portion of a hyperbola, wherein the hyperbolically shaped reflective surface defines a back focal point and a conjugate focal point; and

a receiver disposed to receive the reflected optical signals from said hyperbolic reflector.

18. A fiber optic rotary joint according to Claim 17 wherein the back focal point of said hyperbolic reflector lies along the central axis of the rotor.

19. A fiber optic rotary joint according to Claim 18 wherein said optical source is carried by the stator and said hyperbolic reflector is mounted upon the rotor.

20. A fiber optic rotary joint according to Claim 17 further comprising an elliptical reflector for receiving optical signals from said optical source and for reflecting the optical signals to said hyperbolic reflector, said elliptical reflector comprising a reflective surface shaped to define a portion of an ellipse, wherein the elliptically shaped reflective surface defines first and second focal points and is positioned such that the first focal point lies along a central axis of the rotor.

21. A fiber optic rotary joint according to Claim 20 wherein the second focal point of said elliptical reflector and the back focal point of said hyperbolic reflector are coincident.

22. A fiber optic rotary joint according to Claim 17 wherein said receiver is disposed at the conjugate focal point of said hyperbolic reflector.

23. A fiber optic rotary joint according to Claim 17 wherein said hyperbolic reflector receives optical signals having a plurality of different angles of incidence, and wherein said hyperbolic reflector is positioned such that a path length from said optical source to said receiver is identical for all optical signals reflected by said hyperbolic reflector regardless of the angle of incidence.

24. A fiber optic rotary joint according to Claim 17 further comprising a plurality of optical sources for transmitting optical signals having different respective wavelengths.

25. A fiber optic rotary joint according to Claim 24 further comprising an optical coupler for combining the optical signals having different respective wavelengths.

26. A fiber optic rotary joint according to Claim 24 wherein said receiver comprises a plurality of detectors for receiving optical signals having a respective wavelength.

27. A fiber optic rotary joint according to Claim 26 wherein said receiver further comprises a splitter for separating the optical signals having different respective wavelengths prior to reception by said detectors.

28. A fiber optic rotary joint according to Claim 17 wherein said optical source comprises an array of vertical cavity surface emitting lasers (VCSELs).

29. A fiber optic rotary joint according to Claim 17 further comprising a plurality of hyperbolic reflectors mounted upon and spaced apart about the other one of the rotor and the stator for reflecting the optical signals incident thereupon.

30. A fiber optic rotary joint according to Claim 29 further comprising a coupler for combining the optical signals reflected by the plurality of elliptical reflectors prior to receipt by said receiver.

31. A fiber optic rotary joint according to Claim 29 wherein the plurality of hyperbolic reflectors comprises four circumferentially spaced hyperbolic reflectors for receiving different respective optical signals.

32. A fiber optic rotary joint for providing optical communication between a rotor and a stator comprising:

an optical source carried by one of the rotor and the stator for transmitting optical signals;

a reflector mounted upon the other one of the rotor and the stator for receiving optical signals having a plurality of different angles of incidence and for reflecting the optical signals, wherein said reflector is disposed radially outside of the rotor; and

a receiver disposed to receive the reflected optical signals,

wherein said reflector comprises a reflective surface shaped and positioned such that a path length from said optical source to said receiver is identical for all optical signals reflected by said reflector regardless of the angle of incidence.

33. A fiber optic rotary joint according to Claim 32 wherein said reflector comprises an elliptical reflector having a reflective surface shaped to define a portion of an ellipse, wherein the elliptically shaped reflective surface defines first and second focal points and is positioned such that the first focal point lies along a central axis of the rotor.

34. A fiber optic rotary joint according to Claim 33 wherein said reflector is disposed at the second focal point of said elliptical reflector.

35. A fiber optic rotary joint according to Claim 33 wherein said reflector further comprises a hyperbolic reflector for reflecting the signals received from said elliptical reflector, wherein said hyperbolic reflector comprises a reflective surface shaped to define a portion of a hyperbola, wherein the hyperbolically shaped reflective surface defines a back focal point and a conjugate focal point, and wherein the second focal point of said elliptical reflector and said back focal point of said hyperbolic reflector are coincident.

36. A fiber optic rotary joint according to Claim 35 wherein said reflector is disposed at the conjugate focal point of said hyperbolic reflector.

37. A fiber optic rotary joint according to Claim 32 wherein said optical source is carried by the stator, wherein said reflector is mounted upon the rotor and comprises a hyperbolic reflector having a reflective surface shaped to define a portion of a hyperbola, wherein the hyperbolically shaped reflective surface defines a back focal point and a conjugate focal point, and wherein the back focal point lies along the central axis of the rotor.

38. A fiber optic rotary joint according to Claim 37 further comprising a plurality of optical sources circumferentially spaced about the stator and a plurality of hyperbolic reflectors circumferentially spaced about the rotor such that the optical signals emitted by one of said optical sources are always incident upon one of said hyperbolic reflectors.

39. A fiber optic rotary joint according to Claim 32 further comprising a plurality of optical sources for transmitting optical signals having different respective wavelengths.

40. A fiber optic rotary joint according to Claim 39 further comprising an optical coupler for combining the optical signals having different respective wavelengths.

41. A fiber optic rotary joint according to Claim 39 wherein said receiver comprises a plurality of detectors for receiving optical signals having a respective wavelength.

42. A fiber optic rotary joint according to Claim 41 wherein said receiver further comprises a splitter for separating the optical signals having different respective wavelengths prior to reception by said detectors.

43. A fiber optic rotary joint according to Claim 32 wherein said optical source comprises an array of vertical cavity surface emitting lasers (VCSELs).

44. A fiber optic rotary joint according to Claim 32 further comprising a plurality of reflectors mounted upon and spaced apart about the other one of the rotor and the stator for reflecting the optical signals incident thereupon.

45. A fiber optic rotary joint according to Claim 44 further comprising a coupler for combining the optical signals reflected by the plurality of reflectors prior to receipt by said receiver.

46. A fiber optic rotary joint according to Claim 44 wherein the plurality of reflectors comprises four circumferentially spaced reflectors for receiving different respective optical signals.

47. A reflector assembly comprising:

an elliptical reflector comprising a reflective surface shaped to define a portion of an ellipse, wherein the elliptically shaped reflective surface defines first and second focal points; and

a hyperbolic reflector comprising a reflective surface shaped to define a portion of a hyperbola, wherein the hyperbolically shaped reflective surface defines a back focal point and a conjugate focal point,

wherein the second focal point of said elliptical reflector and said back focal point of said hyperbolic reflector are coincident.

48. A reflector assembly according to Claim 47 further comprising at least one focusing element at the conjugate focal point of said hyperbolic reflector.

49. A reflector assembly according to Claim 47 wherein said elliptical reflector and said hyperbolic reflector are comprised of plastic having a reflective coating disposed upon portions thereof.

50. A reflector assembly according to Claim 47 wherein said elliptical reflector and said hyperbolic reflector comprise are integral.